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Variational spectropolarimetric aerosol retrieval using a neural network based first guess

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As shown by the scientific results of the POLDER mission, spectropolarimetry is a valuable method to retrieve the physical properties of atmospheric aerosols. Aerosol retrievals from spectropolarimetric observations usually rely on variational inversion schemes, where a nonlinear cost function is iteratively minimized starting from a first guess provided by a look-up table (LUT) or by other means. Given the high nonlinearity of the cost function, the quality of the first guess is important for the retrieval speed in terms of number of iterations needed to converge, as well as for its accuracy. In this presentation, we will discuss the possibility of improving the convergence and the accuracy of an aerosol retrieval algorithm by using a first guess provided by a supervised neural network (NN). An algorithm using a NN-based first guess is developed and compared to the SRON operational retrieval scheme – using a LUT-based first guess – on a set of simulated ground-based spectropolarimetric measurements, in presence of radiometric noise and accounting for an uncertain knowledge of the aerosol parameters that are not fitted during the retrieval process. Furthermore, the two algorithms are compared on a small set of real ground-based measurements performed by the Spectropolarimeter for Planetary Exploration (SPEX). The results show that replacing the LUT with a NN in the SRON operational retrieval scheme leads to a considerable increase in the number of retrievals that match the convergence criteria.